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obstructed by the continents. Is it necessary to add that the waters of the ocean, under a pressure of from four hundred to six hundred atmospheres, penetrate deeply into the solid beds upon which the ocean rests, and render these beds more permeable to the heat? It is reasonable, and in no wise contrary to the laws of physics, to conclude that the cooling of our globe, elsewhere excessively slow, has progressed more rapidly and more deeply under the seas than under the continents. This difference has existed for many million years, and ought to have caused in that extent of time a notable variation of thickness in the solid crust. H. FAYE.

#### BACTERIA AND DISEASE.

DR. GEORGE M. STERNBERG, U.S.A., so well known as a writer and investigator in bacteriology, delivered a lecture before the Alumni association of the Long Island college hospital, Brooklyn, on the evening of April 20. The subject upon which he was requested to address the association was, "A general review of the relation of bacteria to disease, including an account of a personal observation of Pasteur's methods in the prevention of hydrophobia, and their results."

The lecturer called attention to the frequent references of late to the labors of Pasteur in his inoculations for hydrophobia. While some of these willingly accorded to Pasteur all the honor he deserved, there were others which criticised adversely not only his methods, but even his professional reputation, charging him with acting the charlatan in keeping his methods secret. It is true that Pasteur has not proclaimed his experiments abroad in all their details; but this is not because he desired to keep them secret, but because he wished to satisfy himself that his methods were right before he encouraged others to undertake them. In this respect he has done what every scientific man would do. He has, however, always been ready to explain to those whom he regarded as competent his method, and even to demonstrate it to them.

The basis of Pasteur's method depending on increase in the virulence of the virus by transmission through a number of rabbits, and its use in gradually increasing potency in inoculation, has already been described in *Science*; and his system of protecting inoculation is too well known to call for further mention at this place.

Before Pasteur inoculated any human beings, he had tested his method upon fifty dogs, and had in every case rendered them immune, that is, insusceptible to hydrophobia. The history of the first person inoculated, Joseph Meister, is too well known to need repetition here. Since this time

(July, 1885), Pasteur has inoculated three hundred and fifty persons. Of course, Pasteur knows as well as any of his adverse critics that all these persons were not bitten by rabid dogs, but he could not refuse to inoculate them. With the exception of the Russians who have recently died, Pasteur has had but one unsuccessful result. In these cases the explanation is probably to be found in the fact that the inoculation was practised too late. It is just so in vaccination, which is recognized as a preventive of small-pox. If we can vaccinate in time, we may abort an attack of small-pox which would otherwise occur; while, if our vaccination is done at the close of the incubatory stage of the small-pox, it will be of no avail.

Dr. Sternberg read a translation of Pasteur's last communication to the French academy, published in the *Comptes rendus* of March 1. In this paper Pasteur gives the results of his inoculations, showing indubitably that the individuals operated upon had in most instances been bitten by rabid animals. These persons had come to him with certificates from medical men and veterinarians, showing this fact beyond a doubt. In speaking of his one apparent failure, Pasteur says that the child was not brought to him until thirty-seven days after the bite was received, and that the wounds in the axilla and the head were in themselves most serious, and that but for the sake of humanity he would have refused to treat the child for the hydrophobia.

Pasteur gives it as his opinion that one death from hydrophobia occurs in every six persons bitten, and that the disease is most apt to occur within forty or sixty days. Of the persons treated by him, one hundred were bitten more than seventy-five days before the publication of his communication, and were still well; another hundred had passed for six weeks to two months; and the others were still well, and time only could tell what would be the result in their cases.

In concluding his remarks upon hydrophobia and the methods of Pasteur, Dr. Sternberg said that the only criticism which suggests itself with reference to this interesting statement of facts is that Pasteur does not attach as much importance to the prophylactic value of early and thorough cauterization as this measure seems entitled to. The considerable number of cases in which cauterization was practised may have had a greater influence upon the favorable result in the extended series of cases reported than Pasteur has been willing to admit. At all events, it will be well to withhold our final judgment as to the value of the method as applied to man until the three hundred and fifty cases reported are all beyond

the limits of time within which the disease may develop, and especially until we have from Pasteur a satisfactory explanation of the failure in the cases of the three wolf-bitten Russians who have recently died of hydrophobia after having submitted to his treatment.

In discussing the relation of bacteria to disease, the lecturer stated, that, in response to a question of his, Pasteur had told him, that, although careful and persistent search had been made, no organism had been found in the hydrophobic virus, and that no difference could be detected between virulent and non-virulent spinal cords. An investigator in Geneva has recently claimed to have discovered the germ of rabies, but the claim lacks confirmation.

In contagious pleuro-pneumonia no germ has yet been discovered which can be considered as the specific micro-organism of the disease. Sternberg, Councilman, and Welch have lately been at work at the problem, but have as yet been unsuccessful.

In the pus of acute abscesses micrococci are invariably found. That the bacillus of anthrax, the spirochaeta of relapsing-fever, the bacillus of tuberculosis, all stand in an etiological relation to those diseases, there now seems to be no doubt. The dispute between the Germans and the English, as to the rôle played by the cholera bacillus in the production of that disease, is still unsettled. The bacillus of typhoid-fever, discovered by Ebert in 1880, is claimed by Koch to be the undoubted germ of that disease. His assistant, Gaffky, invariably finds it in the spleen of those who have died from the fever. Koch thinks that it forms spores. When introduced into the circulation of lower animals, it does not produce typhoid; but nothing can be argued from this, as we do not know that this disease ever affects animals other than man.

#### ACCURATE MOUNTAIN HEIGHTS.<sup>1</sup>

Of the various methods of determining the height of a mountain, the best is undoubtedly that of running a line of levels to its summit. This method is accepted as the standard, and as that by which the errors of the other methods are to be judged. A surprising degree of accuracy can be attained in levelling an ordinary country. Many of the errors compensate, and the final results should generally be accurate within a small fraction of a foot. In ascending a mountain, much greater deviations must be expected. The back sights are usually longer than the fore sights, and therefore errors in the adjustment of

the level or in the correction for atmospheric refraction are cumulative. The effect of the mass of the mountain on the level would produce an error which would not be compensated, and might be large enough to be appreciable. Finally, an error in the length of the levelling-rod would enter to its full proportionate amount. For these reasons much reliance should not be placed upon the fractions of a foot, unless the above sources of error have been considered and proper corrections applied. The precise heights as determined have, however, been given below. The labor and cost prevent its general application to the determination of mountain heights. A few lines of level have been run up the hills and mountains in this portion of the country [New England], generally by the enterprise and enthusiasm of volunteers. A description of several of these has been collected from various sources, in most cases from the local newspapers. The principal results are published below for permanent reference. Doubtless many similar measurements have been made, and it is hoped that they may be communicated to the writer as material for a second paper. As an example of the danger that such material may be totally lost, it may be mentioned that scarcely any of the results given below are contained in the excellent 'Dictionary of altitudes of the United States,' recently published by the U. S. geological survey.

The following table contains a number for reference, the name of the mountain or other object measured, and its height above the mean tide-level of the ocean. Additional information regarding many of these points is contained in the original article in *Appalachia*. Nos. 1 to 10 are taken from 'The geology of New Hampshire,' vol. i.; Nos. 11 to 17, from an article by Mr. J. J. Holbrook, *New Hampshire Sentinel*, Nov. 22, 1877, where the altitudes of several other points in Cheshire county, N.H., are also given. All of these stations are in New Hampshire; Nos. 18 to 43 are in Vermont, and Nos. 44 to 63 in New York.

| STATIONS.                                       | FEET.     |
|---|-----------|
| 1..Mount Washington .....                       | 6,293.000 |
| 2..Upper water-tank, Mount Washington railroad. | 5,800.000 |
| 3..Second tank (Jacob's Ladder).....            | 5,468.000 |
| 4..Waumbek Junction.....                        | 3,910.000 |
| 5..Ammonoosuc Station.....                      | 2,668.000 |
| 6..Halfway House .....                          | 3,849.000 |
| 7..Glen House .....                             | 1,633.000 |
| 8..Kearsarge (S.).....                          | 2,942.790 |
| 9.. " Garden.....                               | 2,622.500 |
| 10.. " Plumbago Point.....                      | 1,705.000 |
| 11..Monadnock.....                              | 3,849.000 |
| 12.. " Mountain House.....                      | 2,071.984 |
| 13..John Mann's, near divide.....               | 1,487.602 |
| 14..Jaffrey Schoolhouse No. 12 (threshold)..... | 1,231.227 |
| 15..Troy Schoolhouse No. 3 (lowest step).....   | 1,166.112 |
| 16..Beech Hill.....                             | 1,660.566 |

<sup>1</sup> From *Appalachia*, iv. 215.